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10/717,246	11/18/2003	Edward William Adams	130924.62121	7752
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PEPPER HAMILTON; LLP; CHRISTOPHER J. BUNTEL; AND KOREN ANDERSON ONE MELLON CENTER, 50TH FLOOR GRANT STREET PITTSBURGH, PA 15219			EXAMINER TSOY, ELENA	
			ART UNIT 1762	PAPER NUMBER

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Please find below and/or attached an Office communication concerning this application or proceeding.

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# Office Action Summary

Application No.

10/717,246

Applicant(s)

ADAMS ET AL.

Examiner

Elena Tsoy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 3, 2006 has been entered.

***Response to Amendment***

Amendment filed on August 3, 2006 has been entered. Claims 1-16 are pending in the application.

***Claim Objections***

1. Objection of claims 12 and 13 has been withdrawn due to amendment.

***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites now a step "(a) **forming** a hydrophobic passivating layer on the surface of the plurality of quantum dot particles" which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification as filed describes that "**Generally**, the inner core also comprises a hydrophobic passivating layer on the semiconductive or metallic material resulting from solvents and/or surfactants used in nanoparticle **manufacture**" (See P19). The specification points out that semiconductive, and metallic "nanoparticles" *generally* include a

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passivating layer of a water-insoluble organic material that results from the method used to manufacture such nanoparticles (See P19). Therefore, the specification as filed does not have a support for the step of **forming** a hydrophobic passivating layer on the surface of the plurality of quantum dot particles.

*Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Rejection of claims 1-16 under 35 U.S.C. 103(a) as being unpatentable over Ma et al in view of Bawendi et al has been withdrawn due to amendment.

6. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bawendi et al (US 6,319,426) in view of Kohn et al (WO 99/24490).

The Examiner Note: instead of WO 99/24490, the Examiner will refer for convenience to US 6,602,497 of the same patent family.

Bawendi et al disclose a method for preparing a population of water-dispersible (See column 3, lines 66-67) semiconductor nanocrystals, which are quantum dot particles (See column 1, lines 34-35; column 7, lines 62-67; column 11, lines 36-44), comprising preparing a population of substantially monodisperse first semiconductor nanocrystal cores (See column 18, lines 13-15), coating the nanocrystal cores with the appropriate semiconductor overcoating layer by introducing the cores and a second semiconductor precursor into a coordinating solvent (See column 18, lines 29-53) thereby preparing semiconductor nanocrystals having an organic layer 40 derived from the coordinating solvent such as trioctylphosphine oxide having a linking moiety 44 with an affinity for the semiconductor surface and a hydrophobic tail 48 extends from the linking moiety (See Fig. 5B; column 17, lines 45-49, 58-64; column 18, lines 53-55). Then, in one embodiment, the method further comprises adding a second outer layer 50 such as a molecule comprised of a inner

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*hydrophobic* region 52 and an terminal *hydrophilic* moiety 54 (claimed amphipathic dispersant), e.g. sodium dioctyl sulfosuccinate, for favorable interaction with an aqueous medium (See Fig. 5B; column 17, lines 49-52). The hydrophobic regions 48, 52 of the inner and outer layers, respectively, interact preferentially in the aqueous medium, to form a micelle encapsulating the nanocrystal therein (See column 17, lines 52-57). The second outer layer 50 can include any surfactant having a non-polar tail and a polar head. Non-limiting examples of **surfactants** include sodium dioctyl sulfosuccinate,  $C_{12}H_{25}(OC_2H_2C_2H_2)_{23}OH$ , even common hand soap, e.g. IVORY soap (essentially a sodium salt of fatty acids), has been successfully used in the preparation of water-soluble nanocrystals (See column 17, lines 65-67; column 18, lines 1-6). The polymer contains pendent carboxylic acid groups permitting substitution of monomer repeating units with hydrophilic or hydrophobic moieties to attenuate the hydrophilic/hydrophobic character of the polymer (See column 2, lines 57-60). For example, the polyethers having free carboxylic acid groups may be derivatized at the carboxylic acid groups with moieties that adjust the hydrophilic/hydrophobic ratio of the polyether to improve aqueous micelle self-formation and stability: e.g. the hydrophobicity of the polyethers can be increased with the attachment of hydrophobic moieties such as cholesterol, stearylamine, and the like, a more hydrophilic polymer without pendent free carboxylic acid groups can be obtained by attachment of hydrophilic moieties to the free carboxylic acid groups, such as ethanolamine (See column 9, lines 12-23).

Bawendi et al fail to teach that a polymer having **two or more** alternating hydrophobic and hydrophilic regions can be used for the micelle encapsulation (Claim 1).

Kohn et al teach that a polyether surfactant comprising strictly alternating poly(alkylene oxide) and aromatic diol monomeric repeating units (See column 2, lines 22-27) so that *hydrophilic and hydrophobic regions are distributed uniformly* along the polymer chain (See column 4, lines 60-63) form self-assembled **micelles** having hydrophobic interiors into which hydrophobic drug particles are incorporated and hydrophilic exteriors which maintain a stable dispersion in aqueous media (See column 1, lines 32-35; column 2, lines 13-21) when mixed with *hydrophobic* drug particles in water (See column 4, lines 55-65; column 9, lines 60-63) thereby forming stable aqueous polymeric **surfactant** dispersions (See column 10, lines 65-67; column 14, lines 1-3). In other words, Kohn et al teach that a polymer having hydrophilic and hydrophobic regions uniformly distributed along the polymer chain is suitable for the use as surfactant for

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forming self-assembled **micelles** having hydrophobic interiors into which hydrophobic drug particles are incorporated and hydrophilic exteriors which maintain a stable dispersion in aqueous media thereby forming stable aqueous polymeric surfactant dispersions of hydrophobic particles. It is held that the selection of a known material based on its **suitability for its intended use** supported a *prima facie obviousness determination* in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a polymer having hydrophilic and hydrophobic regions uniformly distributed along the polymer chain as in Bawendi et al with the expectation of forming *micelle* via interaction of a terminal hydrophobic region of the polymer with hydrophobic tail 48 of the inner layer 40 thereby providing stable aqueous polymeric surfactant dispersions of hydrophobic nanoparticles since Kohn et al teach that a polymer having hydrophilic and hydrophobic regions uniformly distributed along the polymer chain is suitable for the use as surfactant for forming self-assembled **micelles** having hydrophobic interiors into which hydrophobic drug particles are incorporated and hydrophilic exteriors which maintain a stable dispersion in aqueous media thereby forming stable aqueous polymeric surfactant dispersions of hydrophobic particles.

7. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bawendi et al (US 6,319,426) in view of Ma et al (US 5,221,334).

Bawendi et al are applied here for the same reasons as above. Bawendi et al teach that the method comprises coating the hydrophobic passivated semiconductor nanocrystals with an outer layer that stabilizes the semiconductor nanocrystal in aqueous solution (See column 13, lines 1-5). The outer layer includes **any** molecule having at least one hydrophobic linking moiety that attaches to the surface of the particle and that terminates in at least one hydrophilic moiety (amphipathic dispersant) (See column 13, lines 5-28) that can be crosslinked to or polymerized with its neighboring molecules to provide stability to the layer by creating an effectively multidentate ligand across the semiconductor surface as illustrated schematically in FIG. 3 (See column 15, lines 23-32). Exemplary hydrophilic groups, that provide the necessary hydrophilic interactions with water to provide stable solutions or suspensions of the semiconductor nanocrystal, include carboxylic acid groups (See column 14, lines 8-27, column 16, lines 10-67). The outer layer may be coated by adding a nonaqueous solvent to a heated mixture of hydrophobic

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semiconductor nanocrystals with e.g. 30- fold molar excess of the amphipathic molecule having carboxylic acid functional groups (ionizable groups) to form a solution, i.e. admixing hydrophobic semiconductor nanocrystals with e.g. 30- fold molar excess of the amphipathic molecule thereby forming coated semiconductor nanocrystals in the nonaqueous solvent such as THF (See column 21, lines 51-59), rendering the coated semiconductor nanocrystals water-soluble by deprotonation of the carboxylic acid functional groups of the amphipathic molecule by adding a suspension of potassium t-butoxide ionizing agent) in THF to the amphipathic molecule-semiconductor nanocrystal/THF solution (See column 21, lines 61-67), removing the solvent, drying and transferring the coated deprotonated semiconductor nanocrystals to water (See column 21, lines 61-67; column 22, lines 1-5). Bawendi et al teach that the outer layer can be made up of (**any**) molecule having at least one hydrophobic linking moiety that attaches to the surface of the particle and that terminates in at least one hydrophilic moiety (See column 13, lines 5-17). The outer layer may be comprised of a **block copolymer of AB block structure** (See column 6, lines 26-40), wherein a first *hydrophobic block of 3-100 monomer units* (See column 6, lines 56-57) is provided that includes a pendant group capable of functioning as a linking moiety, Y, and a *second hydrophilic block of 3-100 monomer units* (See column 6, lines 57-62), which serves as a **hydrophilic region**, includes at least one pendant group capable of functioning as a hydrophilic group, X (See column 6, lines 26-40). The outer layer can be a mixture of two or more different water-solubilizing molecules, or can comprise additional molecules selected to provide a desirable attribute to the semiconductor nanocrystal (See column 13, lines 17-28).

Bawendi et al fail to teach that the copolymer may have **two or more** alternating hydrophobic and hydrophilic regions (Claim 1).

Ma et al teach that copolymers having hydrophobic and hydrophilic regions where a hydrophobic unit serves to link with a hydrophobic pigment, and the hydrophilic region serves to disperse the pigment in the aqueous medium (See column 3, lines 26-34) is suitable for stabilizing a hydrophobic pigment of 0.005-1microns (5 nm-1000 nm) (See column 7, lines 25-27) in an aqueous medium over long periods (See column 3, lines 15-17). The block copolymers may be either of AB block structure such as **15 EHMA (15 hydrophilic monomer units)//5 MAA (5 hydrophilic monomer units)** (See column 5, lines 33-34) or of ABAB structure with alternating hydrophobic and hydrophilic regions such as **5 BMA(5 hydrophobic monomer units)//10**

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**MAA(10 *hydrophilic monomer units*)/10 BMA(10 *hydrophobic monomer units*)/10 MAA(10 *hydrophilic monomer units*)** (See column 5, lines 62-63).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used copolymers of ABAB structure with alternating hydrophobic and hydrophilic regions where a hydrophobic unit serves to link with a hydrophobic nanoparticle as a dispersant in Bawendi et al instead of copolymer of AB block structure with the expectation of providing the desired stability of aqueous dispersion of nanoparticles since Bawendi et al teach that an outer layer includes any molecule having at least one hydrophobic linking moiety that attaches to the surface of the particle and that terminates in at least one hydrophilic moiety and Ma et al teach that either a copolymer of AB block structure or a copolymer of ABAB structure may be used as dispersant by linking to a hydrophobic particle via a hydrophobic region.

As to claims 2 and 4, Ma et al teach that hydrophilic regions contain ionizable groups such as *acidic* groups (See column 6, lines 12-13). To solubilize the B block into the aqueous medium, it may be necessary to make salts of either the acid or amino groups contained in the B block. Salts of the acid monomers can be made with the counter component being selected from nitrogenous bases and sodium and potassium hydroxides. Amphoteric polymers, that is polymer that contains both an acid group and an amino group, may be used as is or can be neutralized with either addition of acid or base. See column 6, lines 12-39.

As to claim 8, Bawendi et al in view of Ma et al fail to teach that the number ratio of the amphipathic dispersant to the plurality of nanoparticles in step (a) is in the range of approximately 50:1 to approximately 5000:1.

Although Bawendi et al teach a 30-fold excess of the amphipathic molecule in example 2, one of ordinary skill in the art at would know that the amount of the amphipathic molecule would depend on particular amphipathic molecule used.

It is held that concentration limitations are obvious absent a showing of criticality. *Akzo v. E.I. du Pont de Nemours* 1 USPQ 2d 1704 (Fed. Cir. 1987).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant concentration parameters (including those of claim 8) in Bawendi et al in view of Ma et al through routine experimentation in the absence of a showing of criticality.



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As to claim 9, Bawendi et al teach that crosslinking neighboring molecules in the coating outer layer provides stability to the layer by creating an effectively multidentate ligand across the semiconductor surface as illustrated schematically in FIG. 3 (See column 15, lines 23-32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have crosslinked neighboring molecules in Bawendi et al in view of Ma et al the coating outer layer with the expectation of providing the desired stability to the layer by creating an effectively multidentate ligand across the semiconductor surface, as taught by Bawendi et al.

As to claims 11-12, Ma et al teach that the dispersant is a copolymer of a hydrophilic monomer selected from the group consisting of acrylic acid, methacrylic acid and combinations thereof (See column 4, lines 40-43), with at least one hydrophobic alkyl (C1-C9) acrylamide monomer (See column 3, lines 35-43).

As to claims 13-16, Ma et al teach that block copolymers have a number average molecular weight below 20,000, preferably below 15,000, and typically in the range of 1,000 to 3,000 (See column 5, lines 1-6).

### ***Response to Arguments***

8. Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Thursday, 9:00AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

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applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy  
Primary Examiner  
Art Unit 1762

ELENA TSOY  
PRIMARY EXAMINER



August 23, 2006